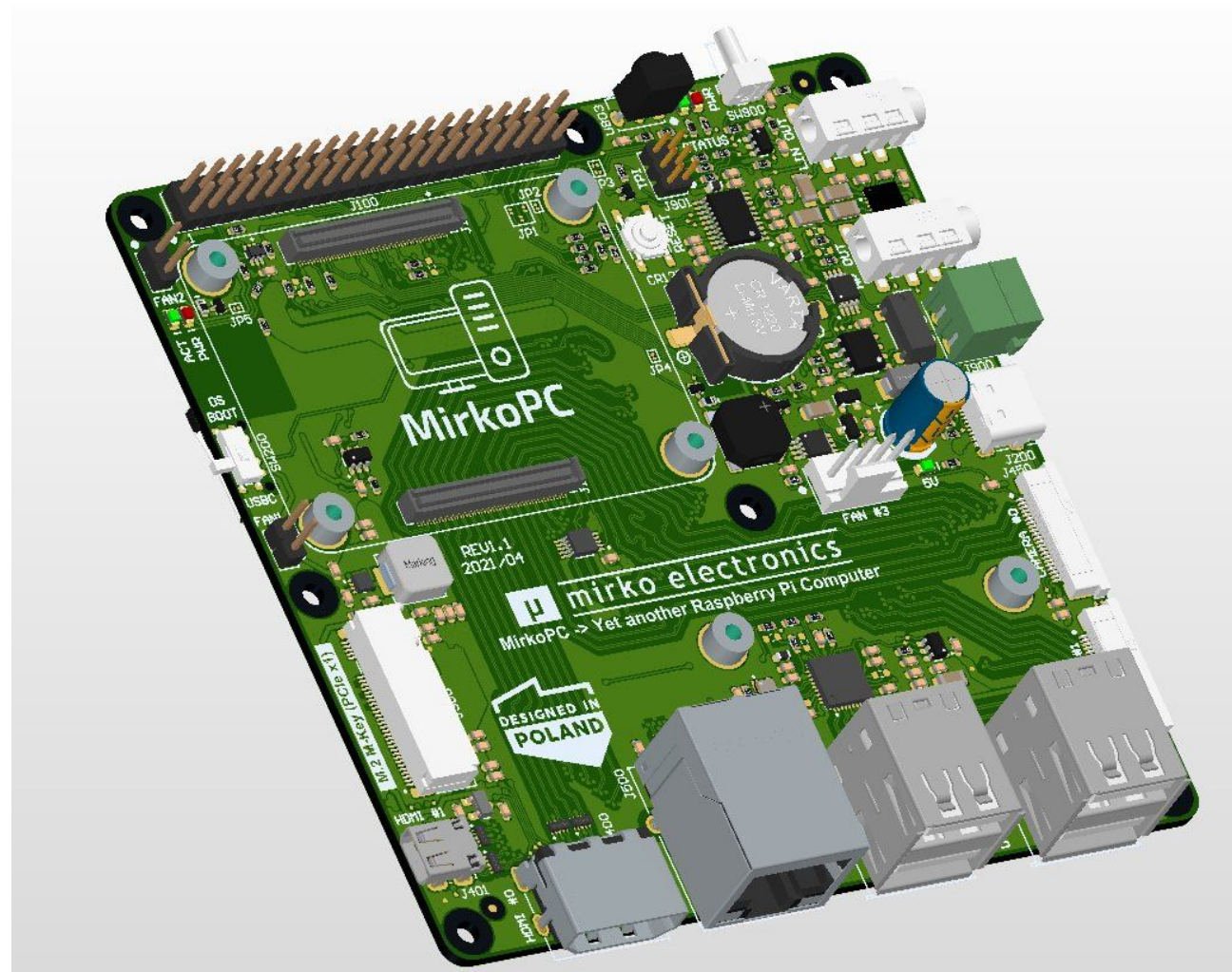


MirkoPC (CM4 carrier board)

TOP VIEW

PCB Project: MirkoPC
Version: VER1
Revision: REV2
Project State: Released
Variant: STD
Print date: 2021-05-07

Page	Index
---	-----
01	Cover page
02	Block diagram
03	Top schematic
04	CM4 module - part #1
05	CM4 module - part #2
06	USB C interface
07	USB Hub
08	PCIe x1 M.2 slot
09	HDMI
10	Camera & Display interfaces
11	100/1000M Ethernet
12	MicroSD card
13	DAC audio output
14	MISC
15	Power supply
16	PCB marking and mechnics
17	Hardware changelog




[02] Block diagram.SchDoc

[03] Top.SchDoc

PCB

PCB BARE BOARD

 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland		Size A3
Title MirkoPC		Project: MirkoPC (CM4 carrier board)		Version VER1
Variant: STD		RefDes: -		Revision REV2
Designer: M. Folejewski		Sheet: 1 / 17		
File Name: [01] Cover page.SchDoc		Printed: 2021-05-07		

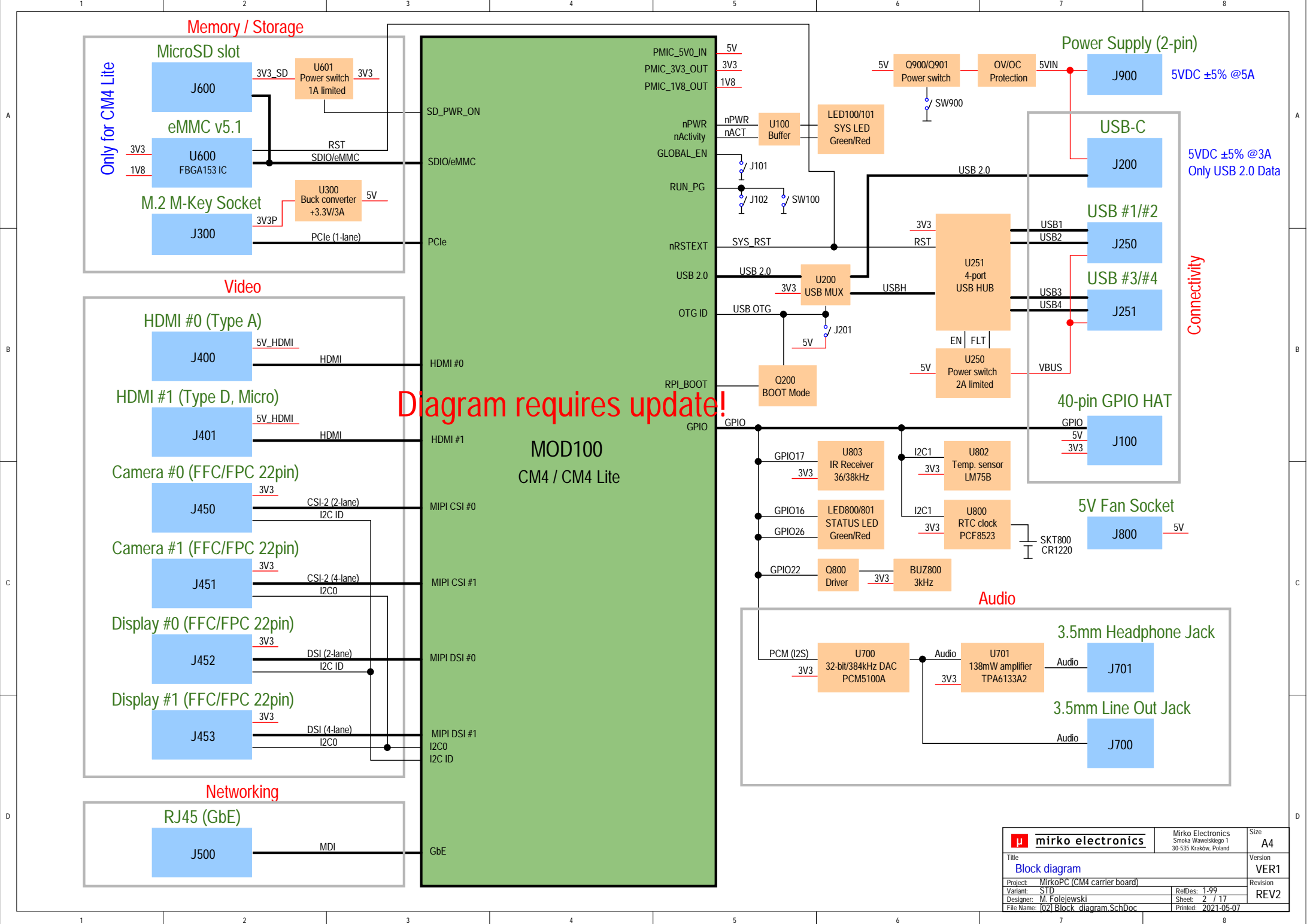


Diagram requires update!

		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland		Size A4
Title Block diagram		Project: MirkoPC (CM4 carrier board)		Version VER1
Variant: STD		RefDes: 1-99		Revision REV2
Designer: M. Folejewski		Sheet: 2 / 17		
File Name: 1021 Block diagram.SchDoc		Printed: 2021-05-07		

A

B

C

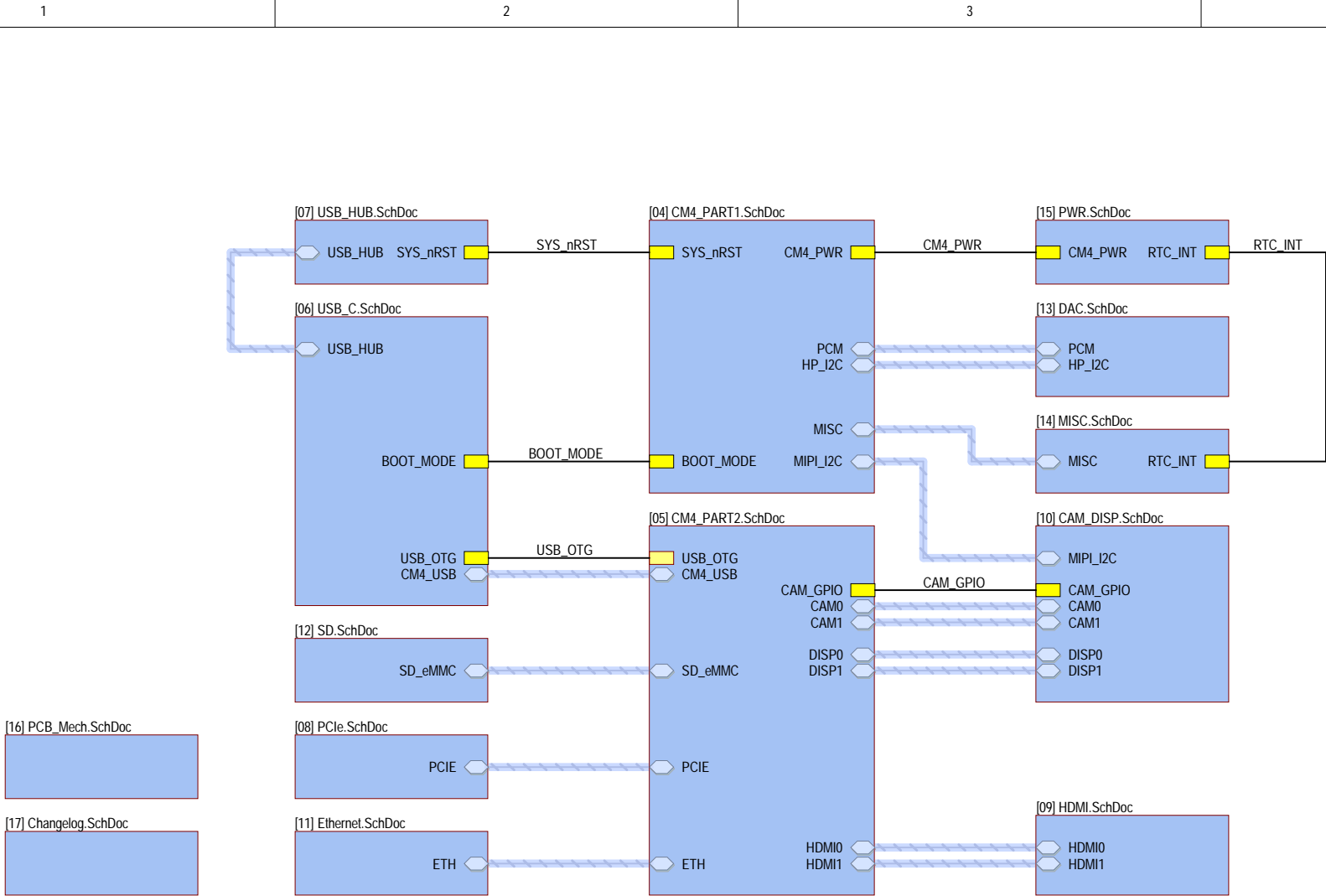
D


A

B

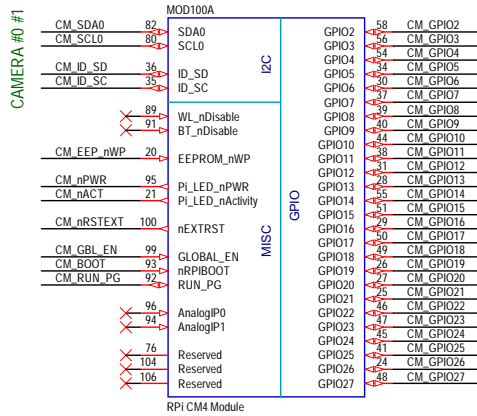
C

D



 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland		Size A4
Title Top schematic				Version VER1
Project: MirkoPC (CM4 carrier board)				Revision REV2
Variant: STD		RefDes: 1-99		
Designer: M. Folejewski		Sheet: 3 / 17		
File Name: [03] TOP.SchDoc		Printed: 2021-05-07		

CM4 MODULE (PART #1)



SCH:

I2C0 Interface: SCL0 pin (GPIO45) and SDA0 pin (GPIO44) typically are used for Camera and Displays and have Internal 1.8k pull up to CM4_3.3V.
ID Interface (ID_SD/ID_SC): CM4 datasheet does not mention about pull-up resistors on ID_SD and ID_SC pins.

I2C1 (GPIO2/GPIO3) have 1.8k pull-up resistors added on CM4 module.

SCH:

I2C (ID_SD/ID_SC): This I2C bus is normally used for identifying HATs (HAT ID EEPROM) and controlling CSI0 and DSI0 devices.
At boot time this I2C interface will be interrogated to look for an EEPROM that identifies the attached board and allows automatic setup of the GPIOs (and optionally, Linux drivers).

DO NOT USE these pins for anything other than attaching an I2C ID EEPROM. Leave unconnected if ID EEPROM not required.

SCH:

I2C0 (SDA0/SCL0): This internal I2C bus is normally allocated to the CSI1 and DSI1 as these devices are controlled by the firmware.

SCH:

nRPBBOOT: A low on this pin force booting from an RPI server. If not used leave floating. Internally pulled via 10K to +3.3V.

SCH:

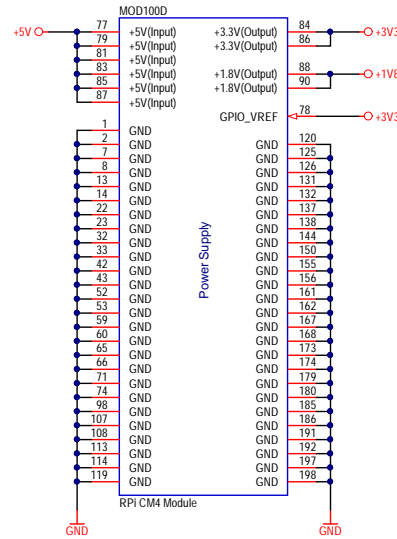
EEPROM_nWP pin: Leaving floating NB Internally pulled up to CM4_3.3V via 100k (VIL <0.8V) but can be grounded to prevent writing to the on board EEPROM which stores the bootcode.

SCH:

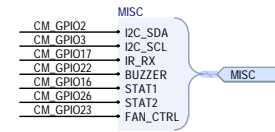
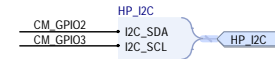
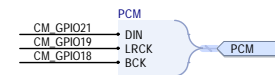
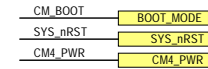
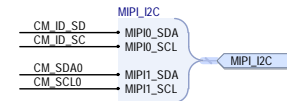
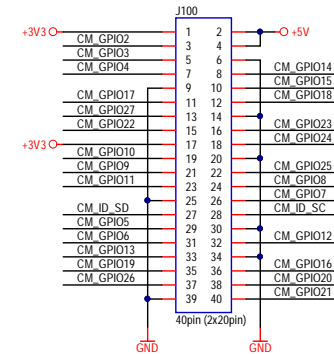
1.8V and 3.3V Outputs +2.5%. Power Output max 300mA per pin for a total of 600mA. This will be powered down during power off or GLOBAL_EN being set low.

SCH:

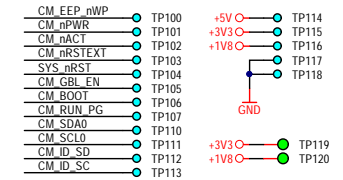
GLOBAL_EN: Drive low to power off CM4. Internally pulled up with a 100K to +5V.



40-PIN GPIO HEADER



TESTPOINTS (DEBUG)



Used GPIOs:

GPIO2 - I2C1 SDA
GPIO3 - I2C1 SCL

GPIO18 - PCM CLK (BCK)
GPIO19 - PCM FS (LRCK)
GPIO21 - PCM DOUT (DAT)

GPIO17 - IR RX

GPIO22 - BUZZER

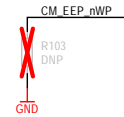
GPIO16 - STATUS1 LED (Green)
GPIO26 - STATUS2 LED (Red)

GPIO23 - FAN #2

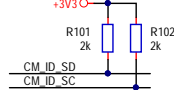
Raspberry Pi Pinout



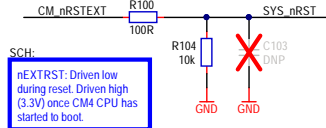
EEP WP



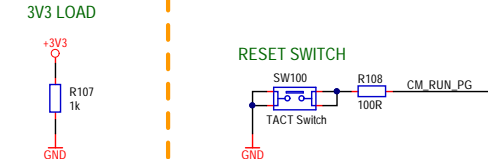
ID I2C



GLOBAL RESET



RUN PG



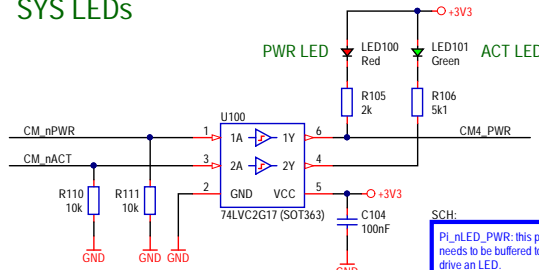
SCH:


Extra load on the 3V3 power rail to fix the HDMI issue with 5V LED.

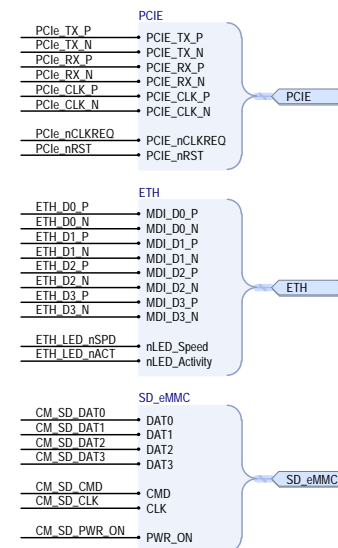
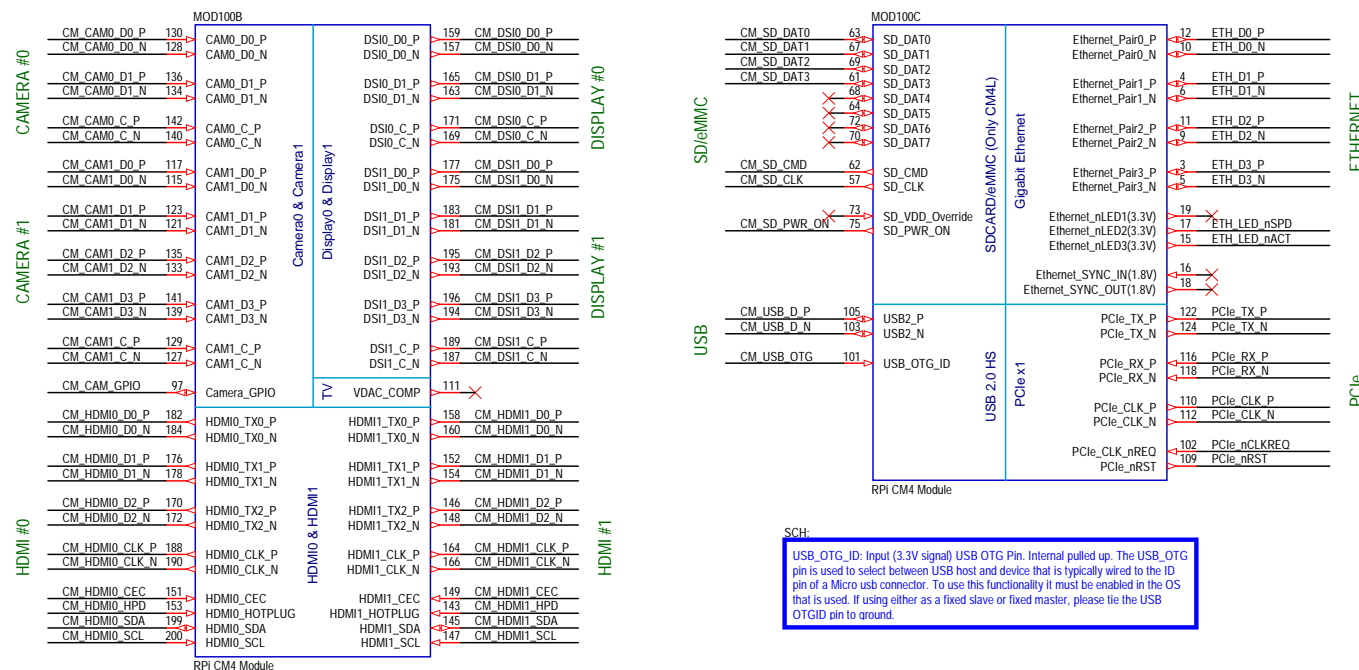
USER:

RUN_PG pin: This pin when high signals that the CM4 has started. Driving this pin low resets the module. This should be done with caution as if files on a filesystem are open they will not be closed.

SYS LEDs



 misko electronics		Misko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A3
Title Compute Module 4 (Part #1)			Version VER1
Project: MiskoPC (CM4 carrier board)			Revision REV2
Variant: STD			
RefDes: 100-199			
Sheet: 4 / 17			
Designer: M. Folejowski			Printed: 2021-05-07
File Name: 041 CM4 PART1.SchDoc			



SCH:

USB_OTG_ID: Input (3.3V signal) USB OTG Pin. Internal pulled up. The USB_OTG pin is used to select between USB host and device that is typically wired to the ID pin of a Micro usb connector. To use this functionality it must be enabled in the OS that is used. If using either as a fixed slave or fixed master, please tie the USB OTGID pin to ground.

LAYOUT:

Route MIPI signals as matched length 100 Ohm differential pairs, each signal within a pair should ideally be matched to better than 0.15mm.

Route USB signals as matched length 90 Ohm differential pairs. The P N signals should ideally be matched to 0.15mm.

Route HDMI signals as matched length 100 Ohm differential pairs, each signal within a pair should ideally be matched to better than 0.15mm. Pairs don't typically need any extra matching as they only have to be matched to 25mm.

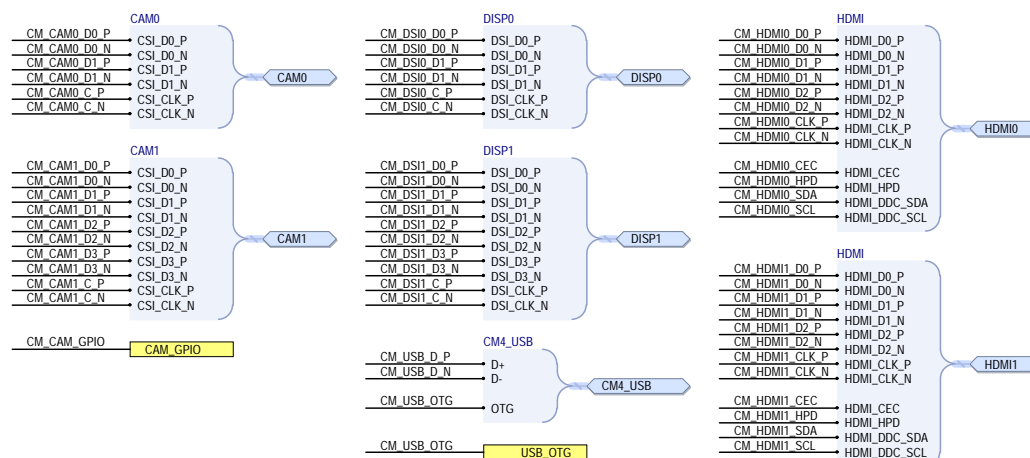
LAYOUT:


Route Ethernet signals as matched length 100 Ohm differential pairs with suitable clearances. Length matching between pairs should be better than 50mm, so in the typical case no length matching is required. However the signals within a pair need to be length matched, ideally to better than 0.15mm.

Route PCIe signals as matched length 90 Ohm differential pairs with suitable clearances. There is no need to match the lengths between pairs, only the signals within a pair need to be length matched ideally to better than 0.1mm.

LAYOUT:

Impedance matching:
90 Ohm -> PCIe, USB
100 Ohm -> HDMI, Ethernet, MIPI (CSI, DSI)



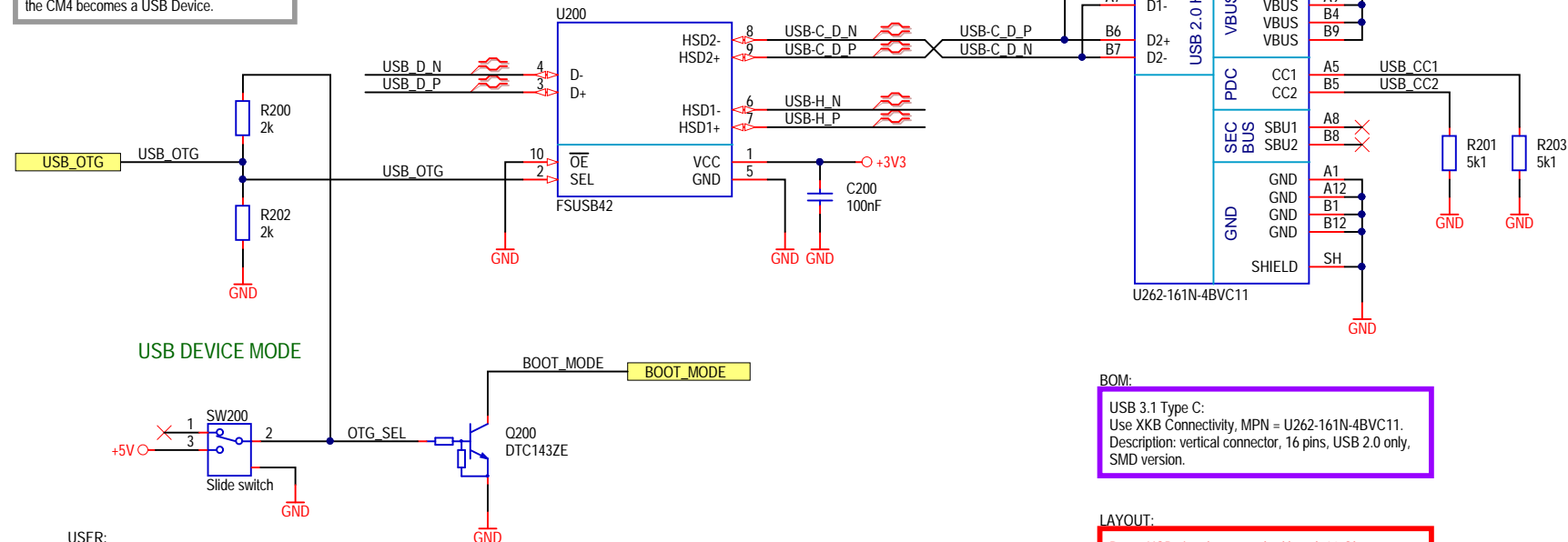
 mirko electronics	Mirko Electronics Smoka Wareńskiego 1 30-535 Kraków, Poland	Size B
Title Compute Module 4 (Part 2)		Version VER1
Project: MirkoPC (CM4 carrier board)	RefDes: 100-199	Revision REV2
Variant: STD	Sheet: 5 / 7	
Designer: M. Folejewski	BrlPrnt: 2021-05-07	
File Name: CM4_PART2_SchDoc		

USER:

USB_OTG line: if USB-C cable is connected and SW200 jumper has shorted 2-3 pins then the CM4 becomes a USB Device.

USB SWITCH

USB TYPE C



USB DEVICE MODE

BOM:

USB 3.1 Type C:
Use XKB Connectivity, MPN = U262-161N-4BVC11.
Description: vertical connector, 16 pins, USB 2.0 only, SMD version.

LAYOUT:

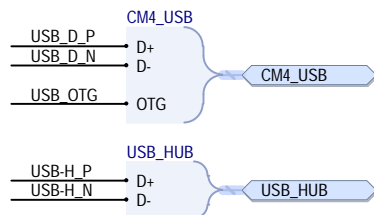
Route USB signals as matched length 90 Ohm differential pairs. The P N signals should ideally be matched to 0.15mm.

USER:

USB DEVICE MODE JUMPER:
1-2 = USB Device disabled (OS BOOT).
2-3 = CM4 connected as USB Device to USB-C cable.

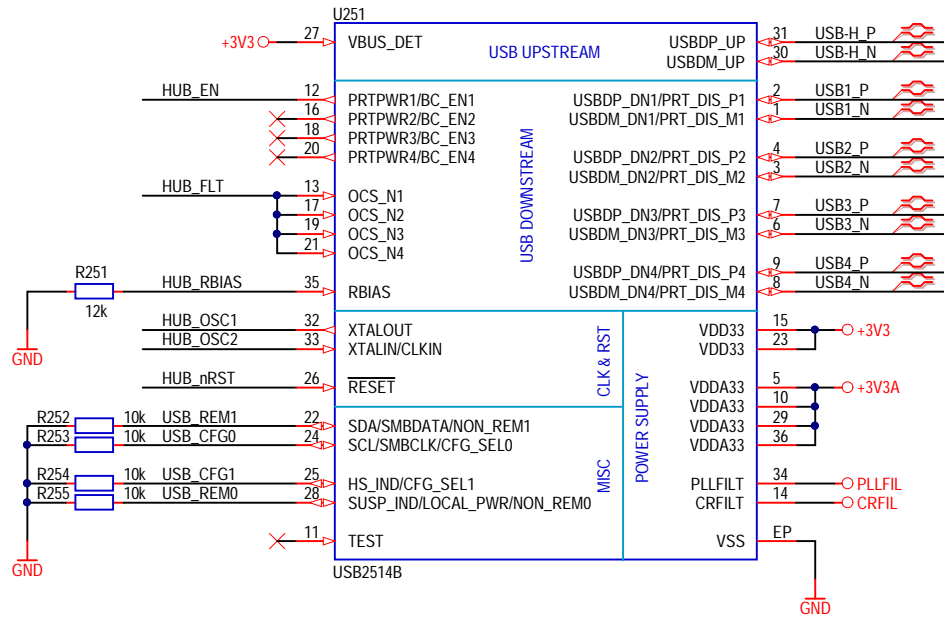
TESTPOINTS (DEBUG)

USB_OTG	TP200
OTG_SEL	TP201
BOOT_MODE	TP202
USB_CC1	TP203
USB_CC2	TP204

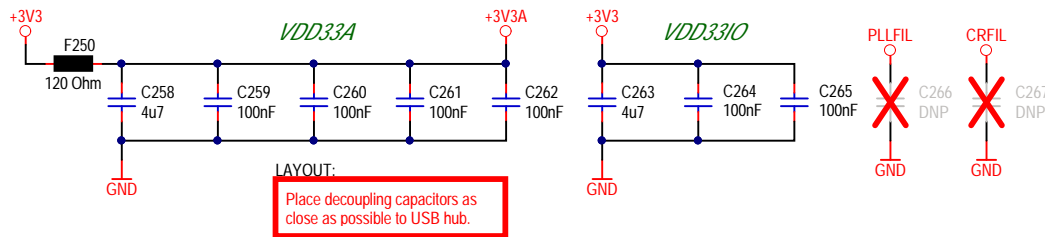


		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title USB-C interface and USB switch		Variant: STD	Version VER1
Project: MirkoPC (CM4 carrier board)		RefDes: 200-249	Revision REV2
Designer: M. Folejewski		Sheet: 6 / 17	
File Name: [06] USB_C.SchDoc		Printed: 2021-05-07	

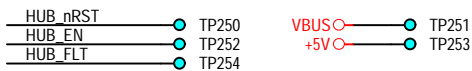
4-PORT USB HUB



DECOUPLING CAPACITORS

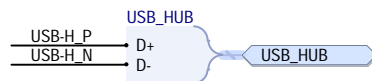


TESTPOINTS (DEBUG)

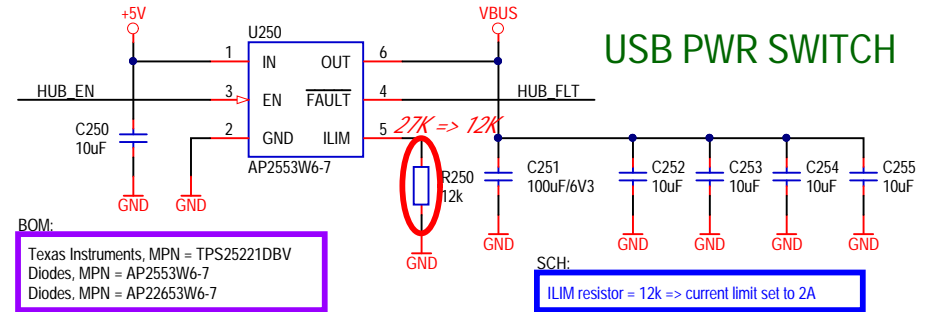


LAYOUT:

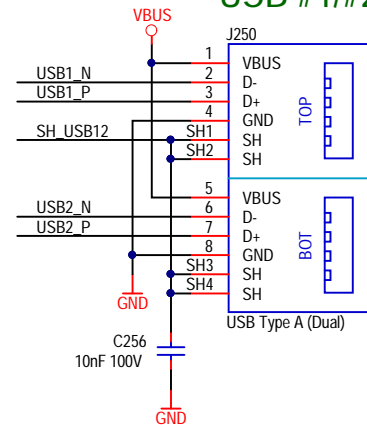
Route USB signals as matched length 90 Ohm differential pairs. The P N signals should ideally be matched to 0.15mm.



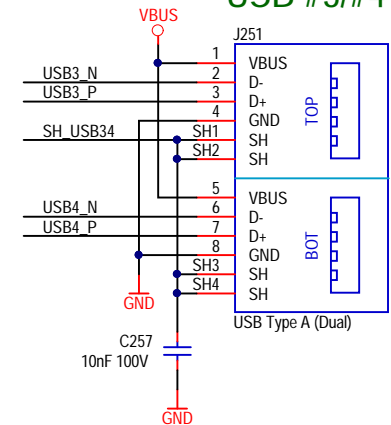
USB PWR SWITCH



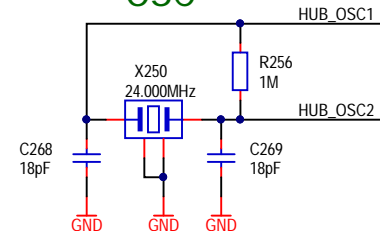
USB #1/#2



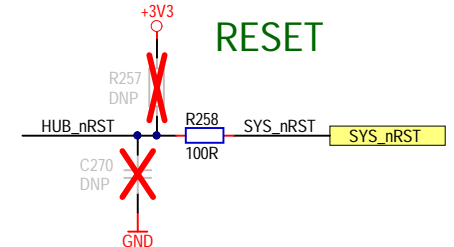
USB #3/#4




OSC

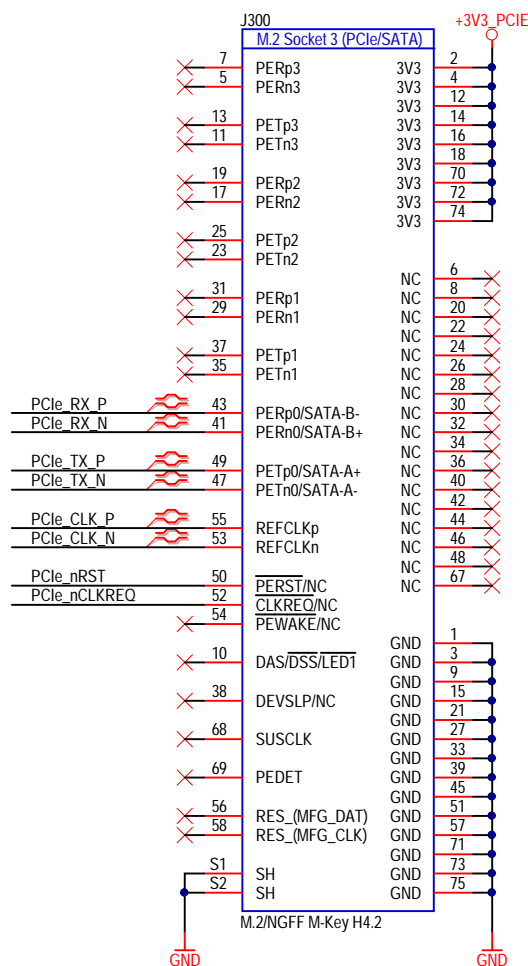


RESET



 <div>mirko electronics</div>		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title 4-port USB 2.0 hub			Version VER1
Project: MirkoPC (CM4 carrier board)			Revision REV2
Variant: STD		RefDes: 250-299	
Designer: M. Folejewski		Sheet: 7 / 17	
File Name: [07] USB_HUB.SchDoc			Printed: 2021-05-07

M.2 Socket 3 (M-Key) PCIe x1



LAYOUT:

Route PCIe signals as matched length 90 Ohm differential pairs with suitable clearances. There is no need to match the lengths between pairs, only the signals within a pair need to be length matched ideally to better than 0.1mm.

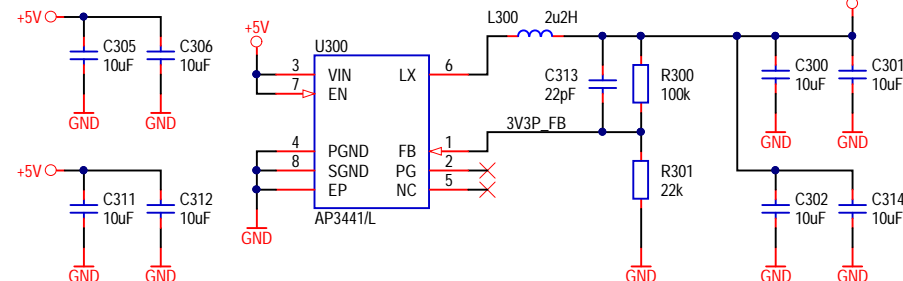
BOM:

NGFF connector:
Description: M.2 (NGFF), M-Key, H4.2.
Lotes, MPN = APCIO107-P001A (H4.2, M-Key).
Lotes, MPN = APCIO113-P001A (H4.8, M-Key).
TE Connectivity, MPN = 1-2199230-5 (H4.2, M-Key).

LAYOUT:

Place decoupling capacitors as close as possible to M.2 connector.

+3.3V @3A



BOM:

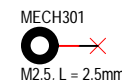
1.0uH -> compatible components:
SXN (Shun Xiang Nuo Elec), MPN = SMMS0630-2R2M
Würth Elektronik, MPN = 744 373 460 22 (WE-LHML, 7030 Series)

LAYOUT:

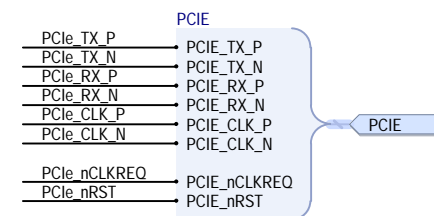
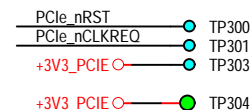
Place decoupling capacitors as close as possible to the Buck converter.

STAND-OFF HEIGHT TABLE

Connector Height Descriptor	L1
H2.3	0.35 ± 0.03
H2.5	0.55 ± 0.03
H2.8	0.80 ± 0.03
H3.2	1.45 ± 0.03
H4.2	2.45 ± 0.03

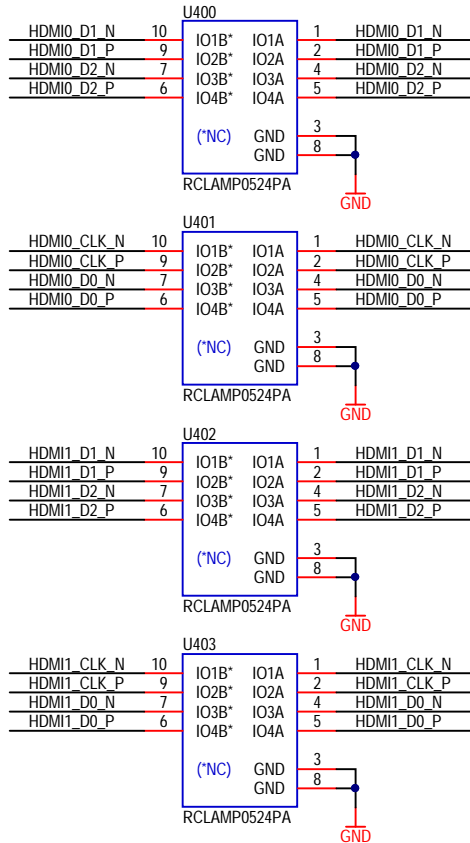


TESTPOINTS (DEBUG)

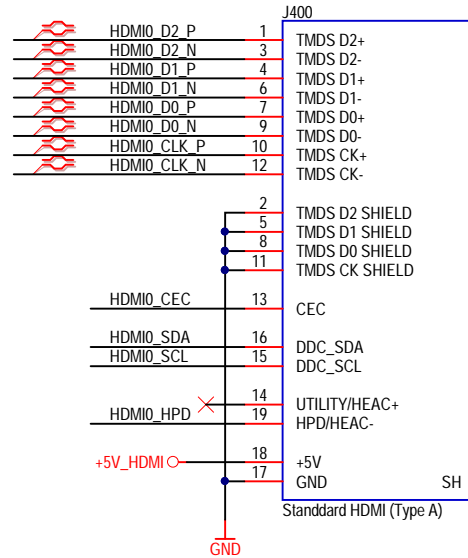


		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title M.2 PCIe x1 Socket		Project: MirkoPC (CM4 carrier board)	Version VER1
Variant: STD	RefDes: 300-399	Revision REV2	
Designer: M. Folejewski	Sheet: 8 / 17		
File Name: [08] PCIe.SchDoc	Printed: 2021-05-07		

ESD PROTECTION



HDMI #0 (TYPE A)



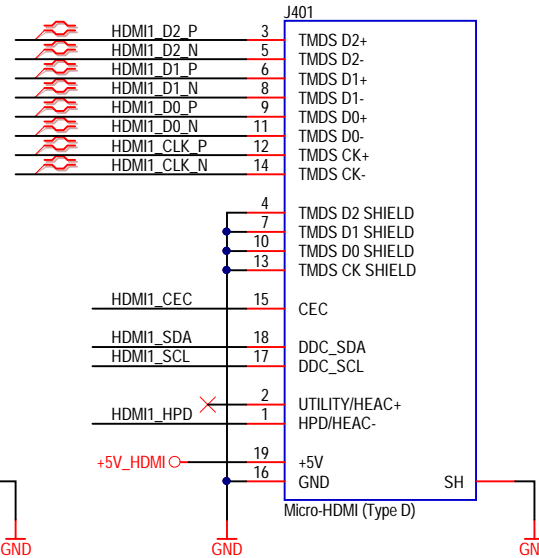
BOM:

HDMI #0 connector:
Wurth Elektronik, MPN = 685 119 134 923
BOOMELE, MPN = HDMI-001
Description: Type A (Standard), 19 pins, 0.50mm pitch, horizontal, SMD.

LAYOUT:

connect IO1A - IO4A on the connector side.

HDMI #1 (TYPE D)



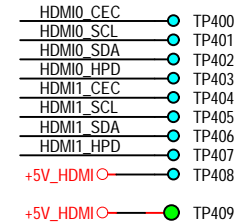
BOM:

HDMI #1 connector:
Wurth Elektronik, MPN = 685 119 248 123
HOAUC, MPN = HYC23-HDMI19-650
Description: Type D (Micro-HDMI), 19 pins, 0.40mm pitch, horizontal, SMD.

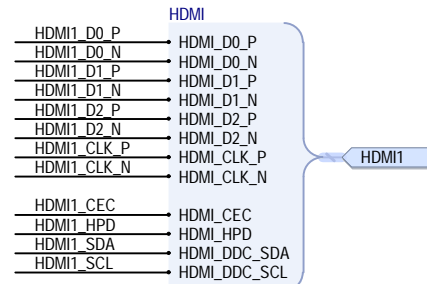
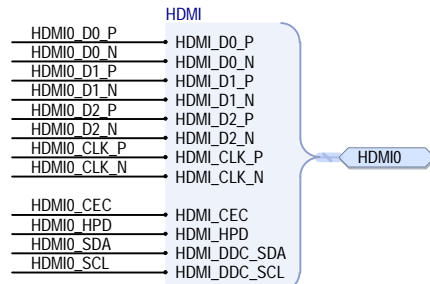
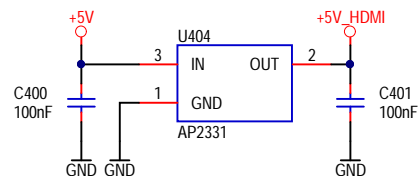
LAYOUT:

Route HDMI signals as matched length 100 Ohm differential pairs, each signal within a pair should ideally be matched to better than 0.15mm. Pairs don't typically need any extra matching as they only have to be matched to 25mm.

TESTPOINTS (DEBUG)

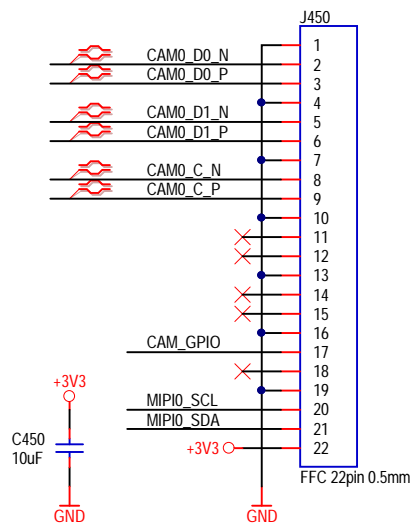


5V POWER SWITCH

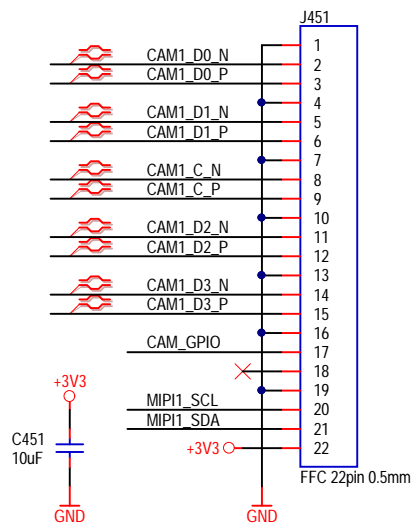


		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title HDMI Interfaces		RefDes: 400-449 Sheet: 9 / 17	Version VER1
Project: MirkoPC (CM4 carrier board) Variant: STD Designer: M. Folejewski File Name: [09] HDMI.SchDoc		Revision REV2	
Printed: 2021-05-07			

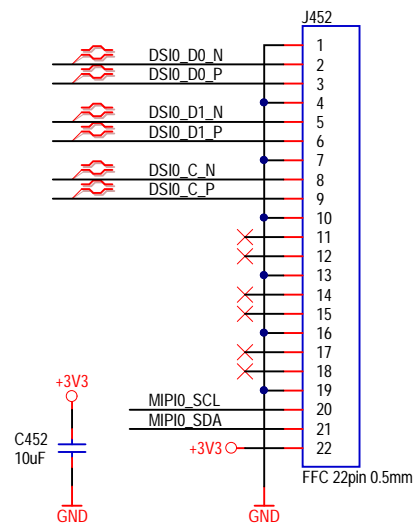
CAMERA #0



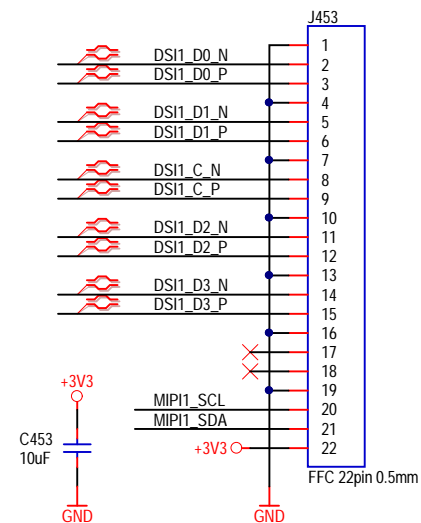
CAMERA #1



DISPLAY #0



DISPLAY #1



LAYOUT:

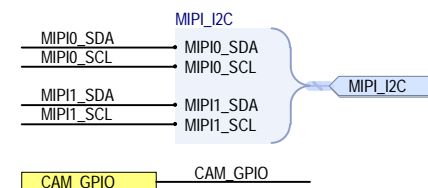
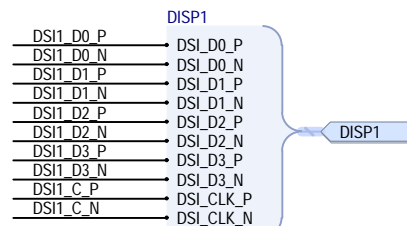
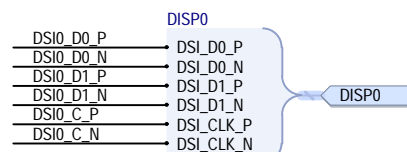
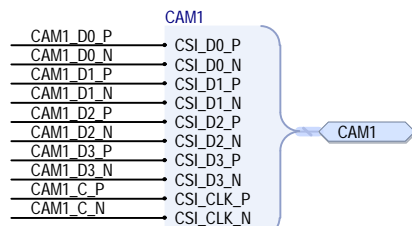
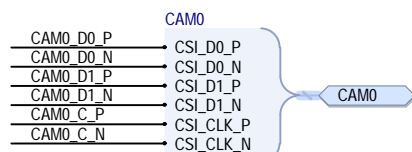
MIPI CSI and DSI signals should be routed as 100 Ohm differential pairs, each signal within a pair should ideally be matched to better than 0.15mm.

BOM:

FFC/FPC connector for Camera interface:
Use XKB Connectivity, MPN = X05B20L22T.
Description: 22 pins, 0.50mm pitch, horizontal, bottom contact.

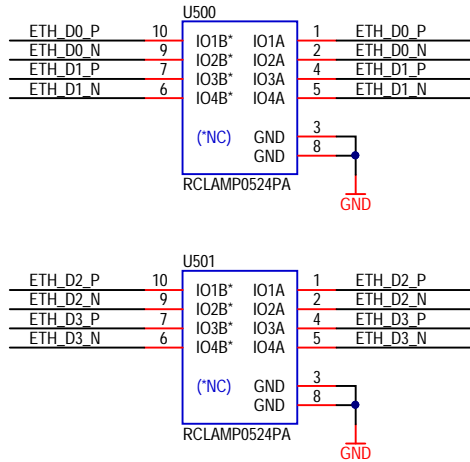
TESTPOINTS (DEBUG)

MIPI0_SCL	TP450
MIPI0_SDA	TP451
MIPI1_SCL	TP452
MIPI1_SDA	TP453
CAM_GPIO	TP454



		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title MIPI CSI & DSI (camera and display interfaces)		Version VER1	Revision REV2
Project: MirkoPC (CM4 carrier board)		RefDes: 450-499	
Variant: STD		Sheet: 10 / 17	
Designer: M. Folejewski		Printed: 2021-05-07	
File Name: [10] CAM_DISP.SchDoc			

ESD PROTECTION



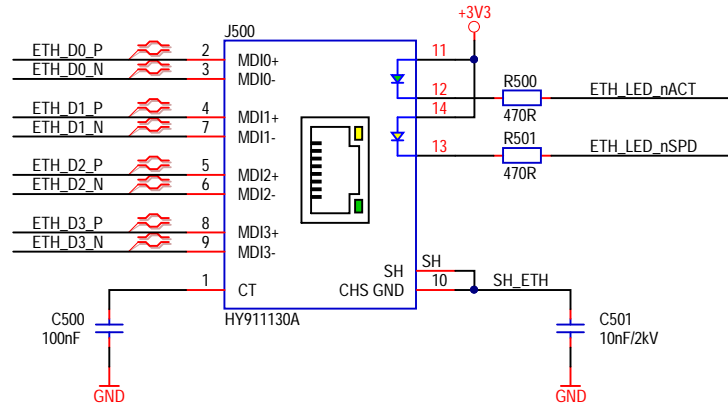
LAYOUT:

connect IO1A - IO4A on the connector side.

LAYOUT:

Place TVS array diodes as close as possible to RJ45 connector.

100/1000M ETHERNET



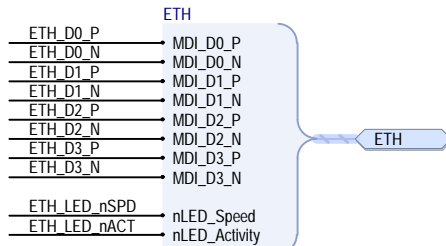
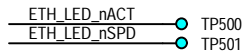
LAYOUT:


Route Ethernet signals as matched length 100 Ohm differential pairs with suitable clearances. Length matching between pairs should be better than 50mm, so in the typical case no length matching is required. However the signals within a pair need to be length matched, ideally to better than 0.15mm.

BOM:

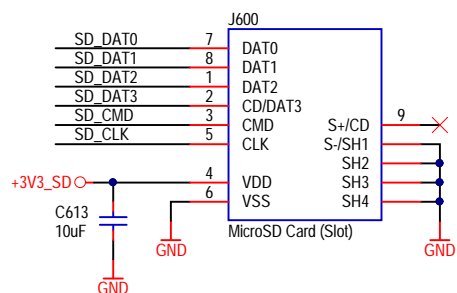
RJ45 -> compatible connectors:
 HanRun, MPN = HR911130A (HY911130A)
 Link-PP, MPN = LPJG0806FBNL
 Description: 100/1000M RJ45, Tab-down, G/Y LEDs

TESTPOINTS (DEBUG)



 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title 100/1000M Ethernet interface			Version VER1
Project: MirkoPC (CM4 carrier board)		RefDes: 500-599 Sheet: 11 / 17 Printed: 2021-05-07	Revision REV2
Variant: STD			
Designer: M. Folejewski			
File Name: [11] Ethernet.SchDoc			

MICRO SD CARD



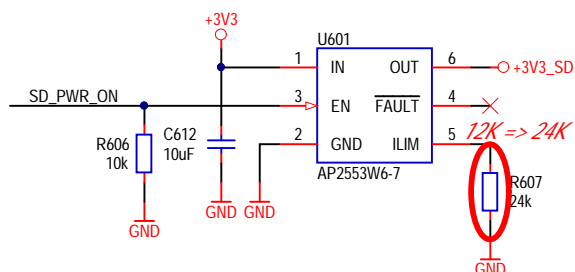
USER:

SD Card only for CM4 Lite module with no on-board Flash memory chip (eMMC).

BOM:

MicroSD slot -> compatible components:
GCT, MPN = MEM2055-00-190-01-A
SOFNG, MPN = TF-015
HOAUC, MPN = HYC77-TF09-200
XUNPU, MPN = TF-115

PWR SWITCH



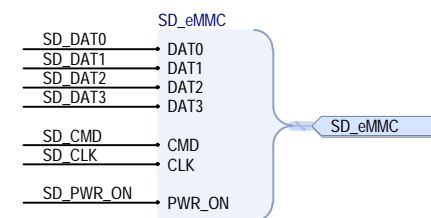
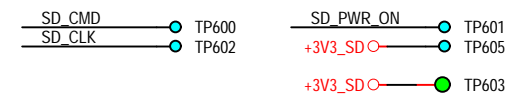
BOM:


Texas Instruments, MPN = TPS25221DBV
Diodes, MPN = AP2553W6-7
Diodes, MPN = AP22653W6-7

SCH:

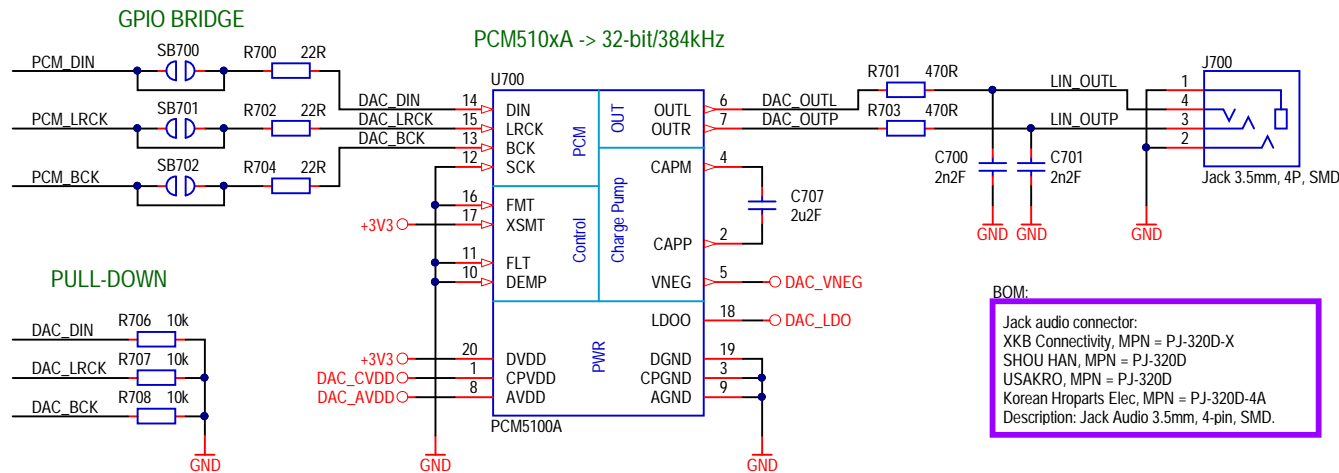
ILIM resistor = 24k => current limit set to 1.05A

TESTPOINTS (DEBUG)

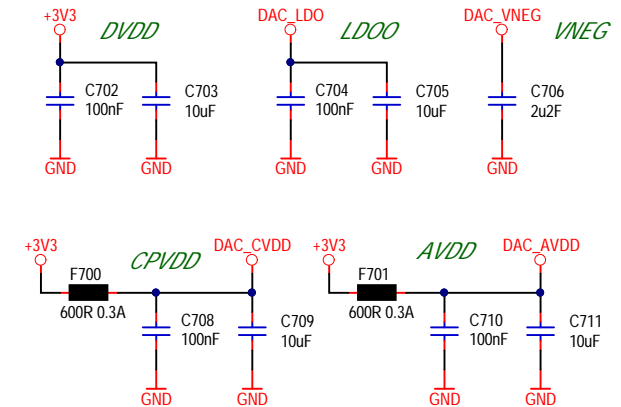


 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title MicroSD slot			Version VER1
Project: MirkoPC (CM4 carrier board)			Revision REV2
Variant: STD		RefDes: 600-699	
Designer: M. Folejewski		Sheet: 12 / 17	
File Name: [12] SD.SchDoc		Printed: 2021-05-07	

DAC Audio



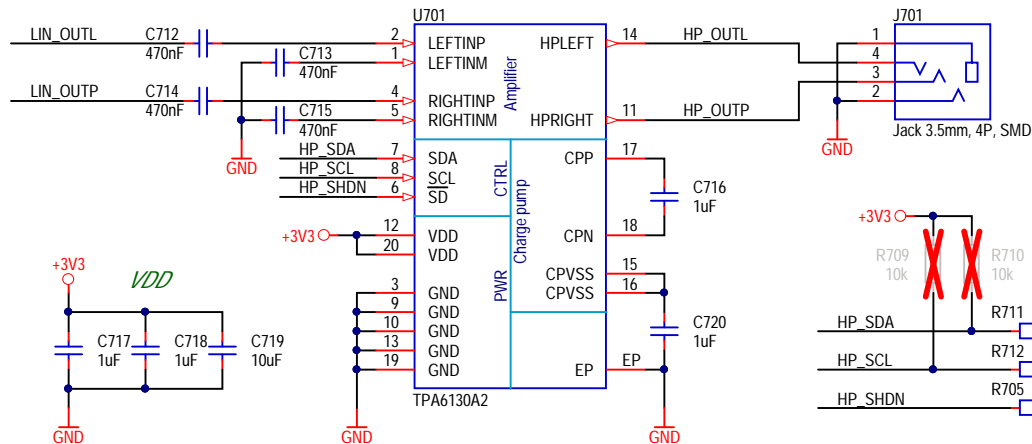
DECOUPLING CAPACITORS



Headphone Amplifier

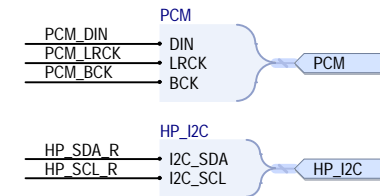
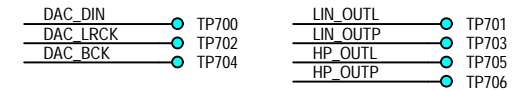
BOM:

470nF -> use film capacitor
Cornell Dubilier, MPN = FCA1206C474M-H3



MPN	I2C	Mounted	Not mounted
TPA6133A2	No	R709, R710	R711, R712
TPA6130A3	Yes	R711, R712	R709, R710

TESTPOINTS (DEBUG)



mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title DAC audio output		Variant: STD	Version VER1
Project: MirkoPC (CM4 carrier board)		RefDes: 700-799	Revision REV2
Designer: M. Folejewski		Sheet: 13 / 17	
File Name: [13] DAC.SchDoc		Printed: 2021-05-07	

1

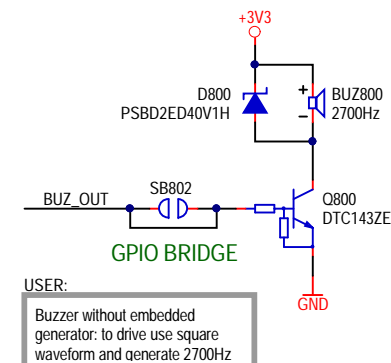
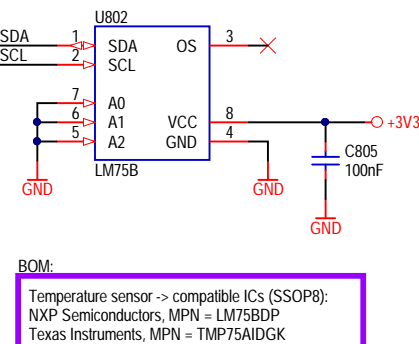
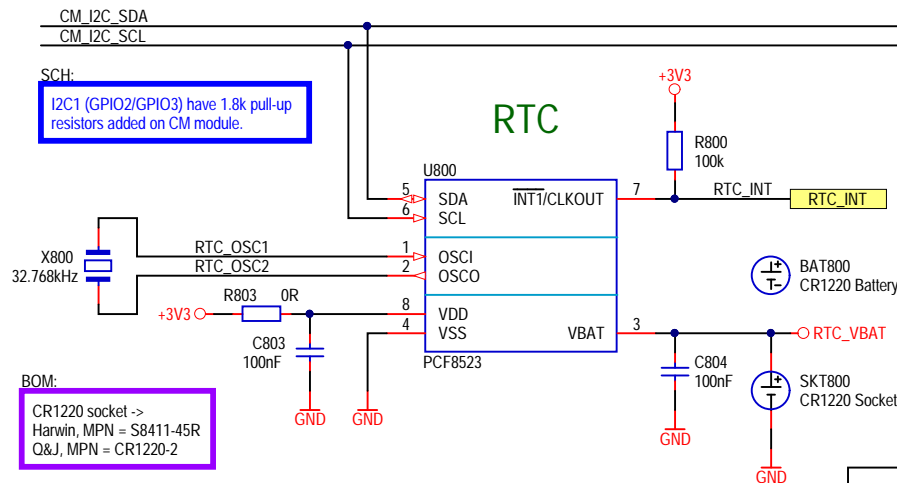
2

3

4

TEMPERATURE SENSOR

BUZZER

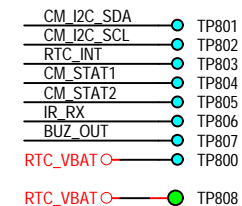
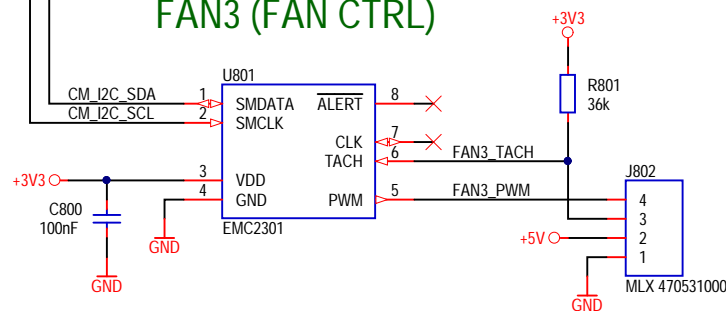
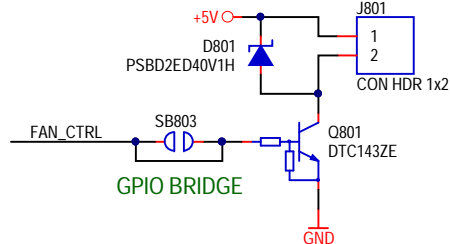
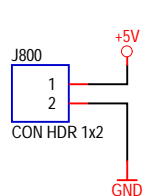


FAN1 (5VDC)

FAN2 (5VDC ON/OFF)

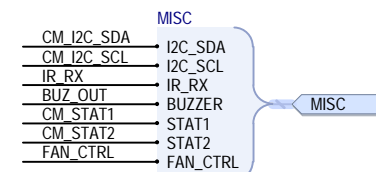
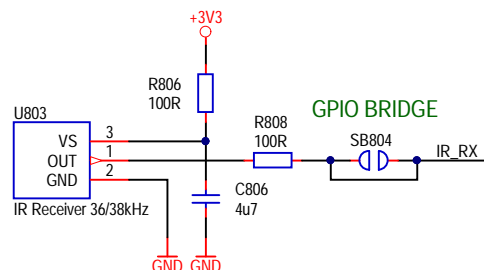
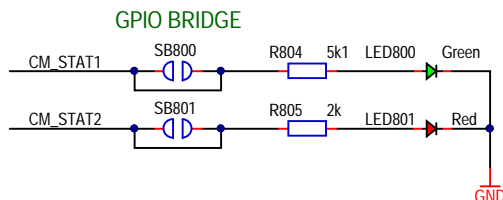
FAN3 (FAN CTRL)


TESTPOINTS (DEBUG)



USER LEDs

IR RECEIVER



 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland		Size A4
Title MISC		RefDes: 800-899 Sheet: 14 / 17		Version VER1
Project: MirkoPC (CM4 carrier board)		Revision REV2		
Variant: STD		Designer: M. Folejewski		
File Name: [14] MISC.SchDoc		Printed: 2021-05-07		

1

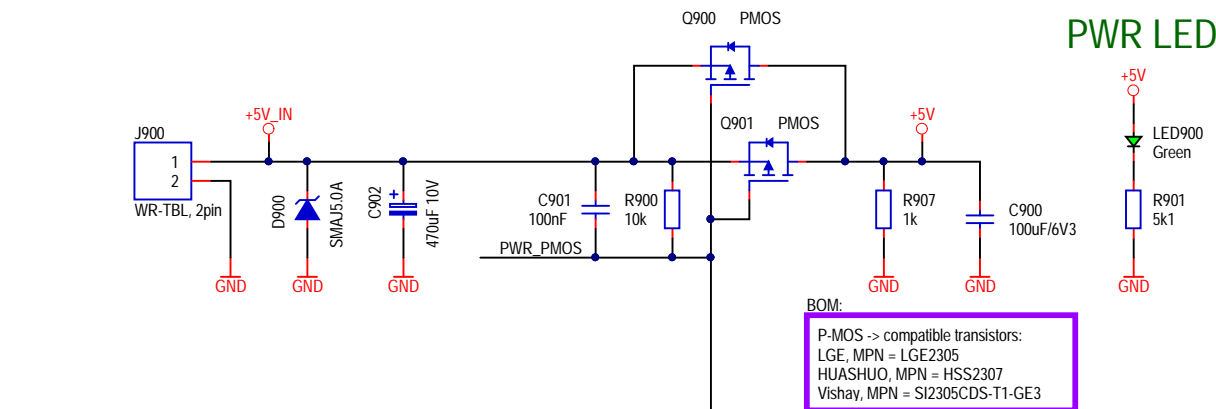
2

3

4

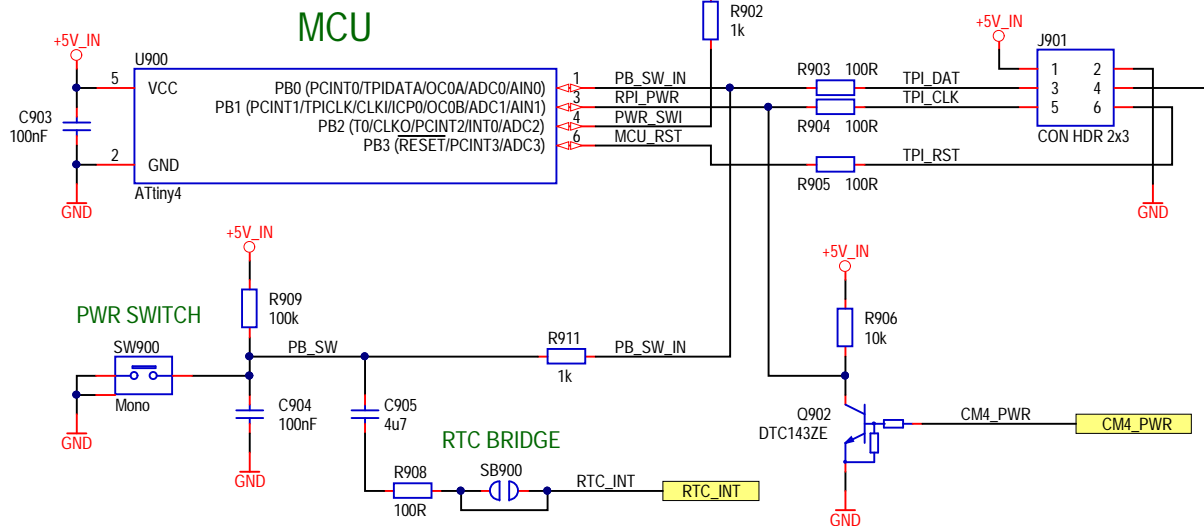
+5V MAIN POWER SUPPLY

PWR LED

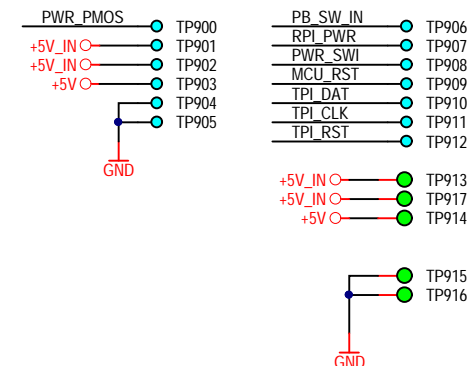



PUSHBUTTON CONTROLLER

MCU ISP (TPI)

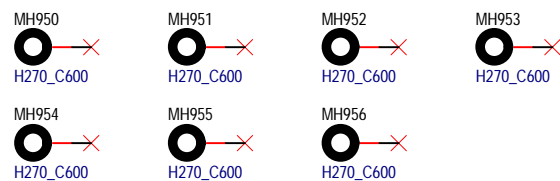


TESTPOINTS (DEBUG)

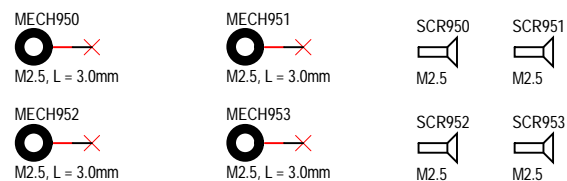


 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title +5V power supply			Version VER1
Project: MirkoPC (CM4 carrier board)			Revision REV2
Variant: STD		RefDes: 900-949	
Designer: M. Folejewski		Sheet: 15 / 17	
File Name: [15] PWR.SchDoc		Printed: 2021-05-07	

PCB MOUNTING HOLES



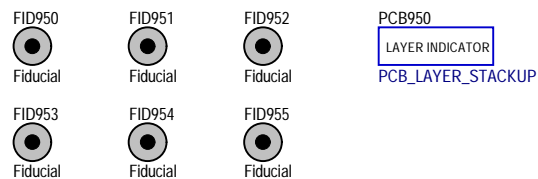
M2.5 STEEL SPACERS




BOM:

SMT Steel Spacer with internal Thread M2.5, L = 3.0mm:
Use Wurth Elektronik, MPN = 977 403 015 1.

PCB MARKING



PCB950
LAYER INDICATOR
PCB_LAYER_STACKUP

 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title PCB marking & mechanical parts			Version VER1
Project: MirkoPC (CM4 carrier board)			Revision REV2
Variant: STD	RefDes: 950-999		
Designer: M. Folejewski	Sheet: 16 / 17		
File Name: [16] PCB_Mech.SchDoc		Printed: 2021-05-07	

Hardware changelog

2021-04-20:

- removed eMMC memory (U600) and its auxiliary components;
- redesigned microSD slot (J600) circuit;
- changed location of microSD slot (J600);

2021-04-23:

- changed U701 from TPA6133A2 -> TPA6130A2 (I2C control supported);
- removed FUS900 (5V rail polymer fuse);

2021-04-24:

- removed: R204, J202 (BOOT jumper);
- added: C902 (5V rail capacitor);
- removed R302, R303 (pull-up resistors for M.2 socket);
- added C311, C312 (bypass capacitors for PCIe buck regulator);
- added R713, R714, R715 (GPIO jumpers);
- added R801, R802, R807, R809, R810 (GPIO jumpers);
- removed J101 (GLOBAL EN jumper);
- added R810, J801, D801, Q801 (FAN2 controller);
- removed J102 (RUN BG jumper);

2021-04-25:

- changed R101, R102, R200, R202, R705 from 2k2 to 2k0;
- removed R902, SW900;
- C901 changed from 1uF to 100nF;
- added components for pushbutton controller: U900, C903, C904, R902 - R912, J901, SW900;

2021-04-26:

- added ICT testpoints;
- added J902, R913;

2021-04-27:

- removed J902, R906, R907, R908, R910, R912;
- R903, R904, R905 changed from 1k to 100R;
- added R906, Q902;
- changed R713, R714, R715, R801, R802, R807, R809, R810 to solder bridges;
- SB700, SB701, SB702, SB800, SB801, SB802, SB803, SB804;
- removed J201, added SW200;
- removed PD_SENSE signal;
- USB-C issue fixed;
- removed R107 and R109 (AIN1 and AIN2 signals);
- TP108, TP109 removed;

2021-04-28:

- added R107, R907;
- added FAN #3 circuit: U801, C800, R801, J802;
- changed BUZ800 MPN;
- added C905, R908 (RTC INT signal);

2021-04-29:

- added SB900;
- changed MECH300, MECH301 from M3 to M2.5;
- changed MECH950, MECH951, MECH952, MECH953 from 1.5mm to 3.0mm;
- changed J103, J104 from 1.5mm to 3.0mm;
- added screws: SCR300, SCR950, SCR951, SCR952, SCR953;
- changed U300 to AP3441SHE-7B;
- added C313, C314;

2021-04-30:

- project release;

 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title Hardware changelog		Version VER1	
Project: MirkoPC (CM4 carrier board)		Revision REV2	
Variant: STD	RefDes: 950-999		
Designer: M. Folejewski	Sheet: 17 / 17		
File Name: [17] Changelog.SchDoc		Printed: 2021-05-07	